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Modeling Coherent Structures in Canopy Flows MITUL LUHAR, University of Southern California — It is well known that flows over vegetation canopies are characterized by the presence of energetic coherent structures. Since the mean profile over dense canopies exhibits an inflection point, the emergence of such structures is often attributed to a Kelvin-Helmholtz instability. However, though stability analyses provide useful mechanistic insights into canopy flows, they are limited in their ability to generate predictions for spectra and coherent structure. The present effort seeks to address this limitation by extending the resolvent formulation (McKeon and Sharma, 2010, *J. Fluid Mech.*) to canopy flows. Under the resolvent formulation, the turbulent velocity field is expressed as a superposition of propagating modes, identified via a gain-based (singular value) decomposition of the Navier-Stokes equations. A key advantage of this approach is that it reconciles multiple mechanisms that lead to high amplification in turbulent flows, including modal instability, transient growth, and critical-layer phenomena. Further, individual high-gain modes can be combined to generate more complete models for coherent structure and velocity spectra. Preliminary resolvent-based model predictions for canopy flows agree well with existing experiments and simulations.

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